

REMARKS

Applicant has canceled claims 18 and 34, amended claims 1, 2, 7, 10, 11, 17, 24-26, 29, 30, 33, 40-43, and added new dependent claims 47 and 48 as set forth above. In view of the above amendments and the following remarks, reconsideration of the outstanding office action is respectfully requested.

The Office has rejected claims 1-3, 6, 8, 9, 17-20, 23, 25-27, 33-36, and 39-43 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,686,961 to Kudo et al. (Kudo), claims 10-12, 15, 16, 29-31 and 38 under 35 U.S.C. 103(a) as being unpatentable over Kudo, claims 4, 5, 13, 14, 21, 22, 28, 32 and 37 under 35 U.S.C. 103(a) as being unpatentable over USPN 6,686,961 Kudo et al in view of the Office's assertion of what is applicant's conceded prior art (Background Information) and claims 7, 24 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kudo in view of U.S. Patent No. to 5,805,213 Spaulding et al. (Spaulding).

Kudo, Spaulding, and the Background Information, alone or in combination, do not disclose or suggest, "providing a grayscale mask for each of the sets of pixel data signals, each of the grayscale masks has one of a range of threshold values for an exposure condition for each of the pixel data signals that indicates when each of the pixel data signals should be filtered . . . applying each of the different median filters to a different of the sets of pixel data signals, wherein the application of the filters to one or more of the pixel data signals in each of the sets of pixel data signals is based on the threshold values for each of the pixel data signals provided by the grayscale mask" as recited in claim 17, "a grayscale masking system with a grayscale mask for each of the sets of pixel data signals, each of the grayscale masks has one of a range of threshold values for an exposure condition for each of the pixel data signals that indicates when each of the pixel data signals should be filtered; a filter system that applies a different median filter each of the sets of pixel data signals, wherein the filtering system applies the different median filters to one or more of the pixel data signals in each of the sets of pixel data signals based on the threshold values for each of the pixel data signals provided by the grayscale mask" as recited in claim 33, "providing a grayscale mask for each of the sets of pixel data signals; and restricting the application of the filters to one or more of the pixel data signals in each of the sets of pixel data signals based on the provided grayscale mask" as recited in claim 40, "providing a grayscale mask for each of the sets of pixel data signals; and restricting the application of the filters to one or more of

the pixel data signals in each of the sets of pixel data signals based on the provided grayscale mask” as recited in claim 42, “a grayscale masking system with a grayscale mask for each of the sets of pixel data signals, each of the grayscale masks has one of a range of threshold values for an exposure condition for each of the pixel data signals that indicates when each of the pixel data signals should be filtered, wherein the filtering system applies the different filters to one or more of the pixel data signals in each of the sets of pixel data signals based on the threshold values for each of the pixel data signals provided by the grayscale mask” as recited in claim 47, “a grayscale masking system with a grayscale mask for each of the sets of pixel data signals, each of the grayscale masks has one of a range of threshold values for an exposure condition for each of the pixel data signals that indicates when each of the pixel data signals should be filtered, wherein the filtering system applies the filters to one or more of the pixel data signals in each of the sets of pixel data signals based on the threshold values for each of the pixel data signals provided by the grayscale mask” as recited in claim 48.

The Office’s attention is respectfully directed to FIG. 7 and to col. 7, lines 47-51 in Kudo which illustrates and disclose subjecting the image data to G, R, and B masking which only reduces to zero any signal other than a G, R, and B pixel. Accordingly, Kudo only teaches or suggests the use of binary or non-grayscale mask. Obviously, this type of masking is very limited and is not very useful for addressing additive noise. Like Kudo, none of the other cited references disclose or suggest these claim limitations.

As discussed on page 9, lines 16-25 in the above-identified patent application, “One implementation of the invention would place grayscale masks 22 in each of the planes. The masks 22 could be assigned to three image channels. The channels could be RGB, luminance/ chrominance (e.g., CIELAB), or other representation. Each mask 22 would comprise of a grayscale image, with the digital value at each pixel encoded to indicate over what exposure/processing conditions the pixel should be filtered. For example, a pixel value of 255 in the first mask channel could indicate that the images luminance value at that pixel should be filtered at any exposure greater than 0.25 seconds, while a pixel value of 128 would indicate that the pixel should only be filtered at exposures greater than 5 seconds, etc”. Accordingly, as discussed on page 6, lines 2-4 in the above-identified patent application, with the grayscale mask the present invention is able to reduce noise through a highly effective adaptive filtering technique.

Therefore, in view of the foregoing amendments and remarks, the Office is respectfully requested to reconsider and withdraw the rejection of claims 17, 33, 40, and 42 and new dependent claims are believed to be in condition for allowance. Since claims 19-24 depend from and contain the limitations of claim 17 and claims 35-39 depend from and contain the limitations of claim 33, they are distinguishable over the cited references and are patentable in the same manner as claims 17 and 33.

Additionally, Kudo, Spaulding, and the Background Information, alone or in combination, do not disclose or suggest, “selecting a different filter for each of the sets of pixel data signals based on at least exposure duration and one or more scene statistics for the provided digital image; and applying each of the different selected filters to a different one of the sets of pixel data signals” as recited in claim 1, “selecting a different filter for each of the transformed sets of pixel data signals based at least on exposure duration and one or more scene statistics for the provided digital image; and applying each of the different selected filters to a different one of the transformed sets of pixel data signals” as recited in claim 10, “selecting a different median filter for each of the sets of pixel data signals based on at least exposure duration and one or more scene statistics for the provided digital image; and applying each of the different median filters to a different one of the sets of pixel data signals” as recited in claim 17, “a filter system comprising at least three different filters, each of the different filters filtering a different one of the sets of pixel data signals for one of the channels; and a filtering adjustment system that adjusts each of the different filters in the filter system based on at least exposure duration and one or more scene statistics for the provided digital image” as recited in claim 25, “a filter system comprising at least two different filters, each of the filters filtering at least one of the transformed sets of pixel data signals for one of the achromatic or chrominance channels and a filtering adjustment system that adjusts each of the filters based on at least exposure duration and one or more scene statistics for the provided digital image” as recited in claim 29, or “a filter system that applies a different median filter to each of the sets of pixel data signals, wherein the filter system applies each of the different median filters to one or more of the pixel data signals in each of the sets of pixel data signals . . . and a filtering adjustment system that adjusts each of the different median filters based on at least exposure duration and one or more scene statistics for the provided digital image” as recited in claim 33.

The Office's attention is respectfully directed to FIG. 7 and to col. 7, lines 47 to col. 8, line 18-51 in Kudo which only discloses a median filter (34) for the set of green pixels and average-interpolation filters (31) for the set of red pixels and for the set of blue pixels, but does not teach or suggest any selection of these filters based on exposure duration and one or more scene statistics for the provided digital image. Additionally, the Office's attention is respectfully directed to col. 9, lines 4-16 in Kudo which discloses:

After bandwidth correction, the image signals are subjected to color balance control performed by a color balance control circuit 8. Color balance control refers to the process of achieving a proper balance of the chrominance signal of the video signal in accordance with the color temperature of the light from the object so that white will be reproduced appropriately as white. Specifically, the camera control CPU 16 calculates G/R and G/B from the R, G, and B data, fed from the colorimetry sensor 21, of the entire light from the object, and thereby the correction gains for the data of the R and B images are determined. In accordance with these correction gains, the color balance control circuit 8 corrects the data of the R and B images. (Emphasis added).

However, again Kudo does not teach or suggest any selection of these filters based on exposure duration and one or more scene statistics for the provided digital image. Like Kudo, none of the other cited references disclose or suggest these claim limitations.

As discussed on page 11, lines 19-29 in the above-identified patent application, "By adjusting and applying the median filters independently in each image channel in the imaging system, each filter can be customized to that image plane, eliminating the need to over-filter some planes and/or leaving objectionable artifacts in other planes. The customized filtering used by the imaging system 10 can be adjusted as needed. For example, the filtering executed by the imaging system 10 can be predetermined and stored in memory 16 for use on every image, can be selected from a pre-defined lookup table which is stored in memory 16 based on some particular factor or factors, such as exposure duration and/or scene statistics, or can be customized each time based on an analysis of each captured image. The filtering operation can be applied by the imaging system 10 at the time of the exposure to the image sensing device 12 or at a later time." Accordingly, as discussed on page 6, lines 2-4 in the above-identified patent application, with the exposure duration and one or more scene statistics the present invention is able to reduce noise through a highly effective, adaptive filtering technique.

Therefore, in view of the foregoing amendments and remarks, the Office is respectfully requested to reconsider and withdraw the rejection of claims 1, 10, 17, 25, 29, and 33. Since claims 2-9, 40, and 41 depend from and contain the limitations of claim 1, claims 11-16 and 42-44 depend from and contain the limitations of claim 10, claims 19-24 depend from and contain the limitations of claim 17, claims 36 and 37 depend from and contain the limitations of claim 35, and claims 26-28 and 46 depend from and contain the limitations of claim 25, claims 30-32 and 45 depend from and contain the limitations of claim 29, and claims 35-39 depend from and contain the limitations of claim 33, they are distinguishable over the cited references and are patentable in the same manner as claims 1, 10, 17, 25, 29, and 33.

Further, Kudo, Spaulding, and the Background Information, alone or in combination, do not disclose or suggest, “wherein each of the different adjusted filters is a median filter and the applying each of the different adjusted filters further comprises replacing each individual pixel data signal within the set of pixel data signals with a median pixel data signal derived from a median value of adjacent pixel data signals within a set radius around the individual pixel data signal” as recited in claim 2, “wherein each of the different adjusted filters is a median filter and the applying each of the different adjusted filters further comprises replacing each individual pixel data signal within the set of pixel data signals with a median pixel data signal derived from a median value of adjacent pixel data signals within a set radius around the individual pixel data signal” as recited in claim 11, “selecting different median filter for each of the sets of pixel data signals based on at least exposure duration and one or more scene statistics for the provided digital image” as recited in claim 17, “wherein each of the different adjusted filters is a median filter and the median filters each replace each individual pixel data signal within the set of pixel data signals with a median pixel data signal derived from a median value of adjacent pixel data signals within a set radius around the individual pixel data signal” as recited in claim 26, “wherein each of the filters is a median filter and the median filters each replace each individual pixel data signal within the set of pixel data signals with a median pixel data signal derived from a median value of adjacent pixel data signals within a set radius around the individual pixel data signal” as recited in claim 30, or “a filter system that applies a different median filter to each of the sets of pixel data signals” as recited in claim 33.

As the Office has acknowledged, Kudo in FIG. 7 discloses only one median filter (34) for the set of green pixels with average-interpolation filters (31) for the set of red pixels and for the set of blue pixels. The Office has also asserted that Kudo in Figure 11 and in col. 7, lines 36-56, col. 8, lines 6-28 and col. 9, lines 4-16, discloses a bandwidth correction circuit (23) and a color balance circuit (8), however again these are not median filters. Similarly, the other cited references do not teach or suggest the claimed invention.

As illustrated in FIGS. 4A-4C and discussed on page 11, lines 3-29, in the above-identified patent application:

Referring to Figures 4A-4D, examples of applying median filters with the imaging system which have been customized for the red, green, and blue channels independently in accordance with one embodiment of the present invention are illustrated. In these examples, the images are labeled with the radii of the median filter for each channel applied by the imaging system 10, e.g., "R:2 G:1 B:3" indicates that the red channel was filtered with a radius of two pixels, the green channel with a radius of one pixel, and the blue channel with a radius of three pixels. As these examples illustrate, the present invention dramatically reduces the apparent degradation due to noise in the image, while suffering less degradation of the image than the median filtering shown in Figures 3A-3D. In this particular embodiment, the filters are median filters which are implemented with the image processing system 14 in accordance with preprogrammed instructions in which each filtered pixel data signal in each pixel is replaced by the median value of the pixel data signals within a set radius from the filtered pixel data signal customized for each color channel, although other filtering processes and/or systems could be used.

By adjusting and applying the median filters independently in each image channel in the imaging system, each filter can be customized to that image plane, eliminating the need to over-filter some planes and/or leaving objectionable artifacts in other planes. The customized filtering used by the imaging system 10 can be adjusted as needed. For example, the filtering executed by the imaging system 10 can be predetermined and stored in memory 16 for use on every image, can be selected from a pre-defined lookup table which is stored in memory 16 based on some particular factor or factors, such as exposure duration and/or scene statistics, or can be customized each time based on an analysis of each captured image. The filtering operation can be applied by the imaging system 10 at the time of the exposure to the image sensing device 12 or at a later time. (Emphasis added).

Accordingly, with the different median filters for each of the color channels the present invention dramatically reduces the apparent degradation due to noise in the image.

Therefore, in view of the foregoing amendments and remarks, the Office is respectfully requested to reconsider and withdraw the rejection of claims 1, 10, 17, 25, 29, and 33. Since claims 3-5 depend from and contain the limitations of claim 2, claims 12-14 depend from and contain the limitations of claim 11, claims 19-24 depend from and contain the limitations of claim 17, claims 36 and 37 depend from and contain the limitations of claim 35, and claims 27 and 28 depend from and contain the limitations of claim 26, claims 31 and 32 depend from and contain the limitations of claim 30, and claims 35-39 depend from and contain the limitations of claim 33, they are distinguishable over the cited references and are patentable in the same manner as claims 1, 10, 17, 25, 29, and 33.

In view of all of the foregoing, Applicant submits that this case is in condition for allowance and such allowance is earnestly solicited.

Respectfully submitted,

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/Gunnar G. Leinberg/
Gunnar G. Leinberg
Registration No. 35,584

NIXON PEABODY LLP
Clinton Square, P.O. Box 31051
Rochester, New York 14603-1051
Telephone: (585) 263-1014
Facsimile: (585) 263-1600